

Appl. No. 10/045,004
Response dated: December 30, 2003
Reply to OA of: September 30, 2003

phrase, "consisting essentially of" limits the claim and excludes components which adversely affect the properties of the composition. Claims 2, 3, 8 and 9 further specify the presence of the additional element of 0.1-4.0 wt% of Ga. These latter claims relate to a five component lead-free solder alloy composition. The lead-free solder alloys of the present invention have better tensile strength and elongation than the conventional tin-lead solder alloys. In addition, the lead-free solder alloys of the present invention have a melting point lower than 200°C, which is close to the 183.5°C of a eutectic tin-lead alloy.

In this regard, the Examiner's attention is most respectfully directed to the experimentation contained in the specification including the control examples set forth on page 4 and the various compositions of the invention described in Examples 1 through 5. The unique combination of properties exhibited by the claimed invention may be seen from these Examples and particularly the associated Figures. Thus, by evidence of record, the features of the claimed invention are clearly demonstrated per the claimed invention which is not suggested from the prior art as would be appreciated by one of ordinary skill in the art to which the invention pertains.

Applicants wish to direct the Examiner's attention to the basic requirements of a prima facie case of obviousness as set forth in the MPEP § 2143. This section states that to establish a prima facie case of obviousness, three basic criteria first must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure. In re Vaack, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Section 2143.03 states that all claim limitations must be taught or suggested by the prior art. In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a

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claim must be considered in judging the patentability of that claim against the prior art." In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

Applicants also most respectfully direct the Examiner's attention to MPEP § 2144.08 (page 2100-114) wherein it is stated that Office personnel should consider all rebuttal argument and evidence presented by applicant and the citation of In re Soni for error in not considering evidence presented in the specification.

The most important point in designing a new solder does not reside in the elemental contents of the alloy but in the combination of the elements that exhibit improved properties. The cited '478 patent is directed to an alloy having an improvement in the stability of the tin-zinc pewter at the time of preparing to a solder paste and aging of the tin-zinc pewter after junction can be suppressed (English translation, paragraph [0009]). The composition of this prior art alloy is an Sn-based alloy containing 3-21% Zn, and less than 0.5% of an additional element selected from Be, Mg, Ca, Sr, Ba, Mn, Ga, In, Ta, P, Sb, Bi, S, Se, Te, and Po. Other examples include Sc, Y, La, Ti, Zr, Cr, Fe, Co, Ni, Cu, Ag, B, Al, Si. Among the examples disclosed in this prior art the closest alloy is 91% Sn, 8.5% Zn and 0.5% Al prepared in Example 9 [paragraph 0050].

However, Applicants most respectfully submit that there is no motivation from the reference to make the necessary selection to arrive at the presently claimed invention. "In determining the propriety of the Patent Office case for obviousness in the first instance, it is necessary to ascertain whether or not the reference teachings would appear to be sufficient for one of ordinary skill in the relevant art having the reference before him to make the proposed substitution, combination, or other modification." In re Linter, 458 F.2d 1013, 1016, 173 USPQ 560, 562 (CCPA 1972). Applicants most respectfully ask, how can one obviously conceive the present invention having an improved wetting and mechanical properties from thousands possible choices taught by this prior art? The referenced patent '478 listed "additional component" yet filed to

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point out the particular properties achieved by the present invention. The Examiner must have further evidences to reject claims 1-9 of the present application under lack of non-obviousness relying on this '478 patent. In re Fritch, 23 USPQ 1780, 1784(Fed Cir. 1992) ("It is impermissible to engage in hindsight reconstruction of the claimed invention, using the applicant's structure as a template and selecting elements from references to fill the gaps.). Accordingly, it is most respectfully requested that this rejection be withdrawn.

As to the rejection of claims 1, 4 and 7 as obvious from the teachings of the JP2000141078, Applicants most respectfully submit that one of ordinary skill in the art would appreciate that the composition of the said solder is composed of, in addition to Sn balance, 0.01-3.0% Al, 0.1-50% In, 0.1-6.0% Ag, 0-6.0% Cu and 0-10% Zn. The composition of this '078 alloy "must" have 0.1-50% In which is different from the solder alloys of the present application and is not suggestive of the claimed invention. Why would one of ordinary leave out an essential alloying element? Again, Applicants' specification may not be used as a teaching reference to arrive at the claimed invention. The '078 patent does not reveal any property (mechanical or thermal) of the solder alloys. However, it is generally known that the addition of In will degrade the mechanical strength of the alloy. This was mentioned by the inventor that In "softens solder" in Abstract. Therefore, as would be appreciated by one of ordinary skill in the art, the addition of Ag and especially Cu, becomes a "must" to "improve mechanical strength". The invention of the present application does not have such a drawback. Accordingly, it is most respectfully requested that this rejection be withdrawn.

USP 6,319,461 claims "A lead-free solder alloy substantially contains Sn and Ti and has a temperature of a liquidus of not greater than 400°C. It is clear that this prior art alloy "must" contain Ti. This is different from the claimed alloy of the present application. In addition, the addition of Ti will raise the liquidus temperature. It was indicated by Table 3 of '461 that the liquidus temperature of the reported alloy systems is greater than 203°C. However, the alloy systems of the present application exhibit a

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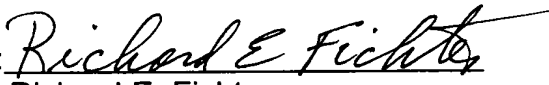
liquidus temperature not greater than 198°C. Accordingly, it is most respectfully requested that this rejection be withdrawn.

The '589 reference discloses alloys which do not contain Al, and optionally contain Zn and Ag among others, for examples P and Ge to prevent oxidation. It is revealed in the present invention that the composition of the metal alloy proposed in the present invention achieve a high mechanical strength as well as a high ductility. This property of the solder alloy of the present invention is a great improvement over conventional solder alloys. In addition, the solder alloy of the present invention exhibits good wettability at the same time. These properties achieved by the present invention were not taught or suggested by any of the references solder alloys and for the above reasons as discussed in the response to the previous rejections, it is most respectfully requested that this rejection be withdrawn.

The above identified application was filed with formal drawings. It is believed that the drawings are acceptable and the Examiner is requested to clarify the record in this regard by checking box 10 in the summary of the action in the next Official Action to indicate that the drawings filed with the application on January 15, 2002 are accepted.

In view of the above comments, favorable reconsideration and allowance of all of the claims now present in the application are most respectfully requested.

Respectfully submitted,
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